

# Annual Report 2011



## Production Sector

### Company Information

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### Annual Report Summary

- ☐ BMP 1: Identify and replace high-bleed pneumatic devices  
☐ BMP 2: Install flash tank separators on glycol dehydrators  
☒ Partner Reported Opportunities (*please specify*):

Re-route blowdowns to compressor suction

Period covered by report: From: Jan. 1, 2011 To: Dec 31, 2011

#### Partner Signature Required:

I hereby certify the accuracy of the data contained in this report.

Mt Wouch

7/24/2012  
Date

- Because the implementation of some technologies reduces emissions for multiple years, Natural Gas STAR allows certain activities to count towards a company's emission reductions beyond the initial year of implementation. Natural Gas STAR designates the maximum length of time that these reductions may accrue as "sunset dates." The Appendix lists these sunset dates. Companies can report the corresponding methane emission reductions each year up to the allowable sunset date. Or, companies may wish to report reductions only once for the implementation year, and have EPA automatically apply the sunset date and count those emissions for the allowable number of years.
- In addition to reporting methane emissions reductions, you are welcome to include other information about your company's participation in Natural Gas STAR in the "Additional Program Accomplishments" section of this form. The Natural Gas STAR Program will use any information entered in this section to recognize the efforts and accomplishments of outstanding partners.



## Production Sector Annual Report

OMB Control No. 2060-0328  
Expires 07/31/2011

### BMP 1: Identify and Replace High-Bleed Pneumatic Devices

#### Current Year Activities

A. Facility/location identifier information: \_\_\_\_\_

**B. Facility summary:**

Number of devices replaced: \_\_\_\_\_ devices

Percent of system now equipped with  
low/no-bleed units: \_\_\_\_\_ %

**C. Cost summary:**

Estimated cost per replacement  
(including equipment and labor): \$ \_\_\_\_\_ /replacement

D. Methane emissions reduction: \_\_\_\_\_ Mcf

E. Are these emissions reductions a one-year reduction or a  
multi-year reduction? ☐ One-year ☐ Multi-year

**If Multi-year:**

☐ Partner will report this activity once and let EPA  
automatically calculate future emission reductions based on  
sunset date duration (BMP 1 has a sunset period of 7 years).

☐ Partner will report this activity annually up to allowed  
sunset date.

**Please identify the basis for the emissions reduction estimate, using the space provided to show any calculations**

☐ Standard calculation

*Methane emissions reduction = [Annual emissions from high-bleed  
devices being replaced (in Mcf/yr) - Annual emissions for the  
replacement devices (in Mcf/yr)] x Number of devices replaced*

*Please specify your data source:*

- ☐ Field measurement  
☐ Manufacturer specifications

☐ Calculation using default

*Methane emissions reduction = 124 Mcf/yr x Number of devices replaced*

☐ Other (please specify): \_\_\_\_\_

F. Total value of gas saved: \$ \_\_\_\_\_

*Total value of gas saved = Methane emissions reduction (in Mcf) x  
Gas value (in \$/Mcf) [If not known, use default of \$7.00/Mcf]*

G. How many high-bleed  
devices do you plan to  
replace next year? \_\_\_\_\_ devices

#### Previous Years' Activities

Use the table below to report any past activities implemented, but not previously reported to the Natural Gas STAR Program

Year	# Devices Replaced	Total Cost of Replacements (incl. equipment and labor) (\$)	Estimated Reductions (Mcf/yr)	Value of Gas Saved (\$)

**BMP 1 Comments:** Please use the back of the page for additional space if needed.



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### BMP 2: Install Flash Tank Separators on Glycol Dehydrators

#### Current Year Activities

A. Facility/location identifier information: \_\_\_\_\_

**B. Facility summary:**

Number of flash tank separators installed: \_\_\_\_\_ separators

Percent of dehydrators in system equipped with flash tank separators: \_\_\_\_\_ %

**C. Cost summary:**

Estimated cost per flash tank separator installation (including equipment and labor): \$ \_\_\_\_\_ /installation

D. Methane emissions reduction: \_\_\_\_\_ Mcf

E. Are these emissions reductions a one-year reduction or a multi-year reduction? ☐ One-year ☐ Multi-year

**If Multi-year:**

☐ Partner will report this activity once and let EPA automatically calculate future emission reductions based on sunset date duration (BMP 2 has a sunset period of 10 years).

☐ Partner will report this activity annually up to allowed sunset date.

**Please identify the basis for the emissions reduction estimate, using the space provided to show any calculations**

☐ Standard calculation

*Methane emissions reduction per flash tank installation = [TEG circulation rate (in gal/hr) x Methane entrainment rate (in scf/gal) \* x hours of operation (in hrs/yr) x 0.90] / 1,000*

*\*If methane entrainment rate is not known, use a default value of 3 scf/gal for energy exchange pumps or 1 scf/gal for electric pumps*

*Please specify your data source:*

- ☐ Field measurement  
☐ Manufacturer specifications

☐ Calculation using default

*Methane emissions reduction = [Average gas throughput (in MMcf/yr) x 170 scf/MMcf x 0.90] / 1,000*

☐ Other (please specify): \_\_\_\_\_

F. Total value of gas saved: \$ \_\_\_\_\_

*Total value of gas saved = Methane emissions reduction (in Mcf) x Gas value (in \$/Mcf) (If not known, use default of \$7.00/Mcf)*

G. How many flash tank separators do you plan to install next year? \_\_\_\_\_ flash tank separators

#### Previous Years' Activities

Use the table below to report any past activities implemented, but not previously reported to the Natural Gas STAR Program

Year	# Flash Tank Separators Installed	Total Cost of Installation (incl. equipment and labor) (\$)	Estimated Reductions (Mcf/yr)	Value of Gas Saved (\$)

**BMP 2 Comments:** Please use the back of the page for additional space if needed.



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### Partner Reported Opportunities (PROs)

For more details on PROs, visit [epa.gov/gasstar/tools/recommended.html](http://epa.gov/gasstar/tools/recommended.html)

### Current Year Activities

**A. Facility/location identifier information:** *PRO-8.2011 East Haynesville Field Facilities*

**B. Activity description:** Please provide a separate PRO reporting form for each activity reported. If reporting a DI&M activity, please use a separate page for each location/facility surveyed.

Please specify the technology or practice that was implemented (choose from the list in the appendix or describe your own):

Redesign of blowdown systems (compressors)

Please describe how your company implemented this activity:

Re-routed blowdowns from discharge to atmosphere into suction line of compressors.

**C. Level of Implementation** (check one):

- ☒ Number of units installed: 10 units  
☒ Frequency of practice: 214 times/year

**D. Are emissions reductions a one-year reduction or a multi-year reduction?** ☐ One-year ☒ Multi-year

**If Multi-year:**

☒ Partner will report this activity once and let EPA automatically calculate future emission reductions based on sunset date duration\*.

☐ Partner will report this activity annually up to allowed sunset date.

**E. Methane emissions reduction** 23.8 Mcf

**F. Cost summary:** Estimated cost of implementing this practice/activity (including equipment and labor): \$ 10,000

**Please identify the basis for the emissions reduction estimate, using the space provided to show any calculations**

- ☐ Actual field measurement  
☒ Calculation using manufacturer specifications/other source

☐ Other (please specify):

*Based on gas volume released per blowdown, as calculated by maintenance contractor, and 480 blowdowns per year.*

**G. Total value of gas saved:** \$ 166.60

*Total value of gas saved = Methane emissions reduction (in Mcf)  
x Gas value (in \$/Mcf) [If not known, use default of \$7.00/Mcf]*

**H. To what extent do you expect to implement this practice next year?**

Plan to complete in 2012.

### Previous Years' Activities

Use the table below to report any past implementation of this PRO, but not previously reported to Natural Gas STAR

Year	Frequency of Practice/Activity or # of Installations	Total Cost of Practice/Activity (incl. equipment and labor) (\$)	Estimated Reductions (Mcf/yr)	Value of Gas Saved (\$)



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### Partner Reported Opportunities (PROs)

For more details on PROs, visit [epa.gov/gasstar/tools/recommended.html](http://epa.gov/gasstar/tools/recommended.html)

#### Current Year Activities

**A. Facility/location identifier information:** \_\_\_\_\_

**B. Activity description:** Please provide a separate PRO reporting form for each activity reported. If reporting a DI&M activity, please use a separate page for each location/facility surveyed.

Please specify the technology or practice that was implemented (choose from the list in the appendix or describe your own):

Please describe how your company implemented this activity:

**C. Level of Implementation** (check one):

- ☐ Number of units installed: \_\_\_\_\_ units  
☐ Frequency of practice: \_\_\_\_\_ times/year

**D. Are emissions reductions a one-year reduction or a multi-year reduction?** ☐ One-year ☒ Multi-year

**If Multi-year:**

- ☐ Partner will report this activity once and let EPA automatically calculate future emission reductions based on sunset date duration\*.  
☐ Partner will report this activity annually up to allowed sunset date.

**E. Methane emissions reduction:** \_\_\_\_\_ Mcf

**F. Cost summary:** Estimated cost of implementing this practice/activity (including equipment and labor): \$ \_\_\_\_\_

**Please identify the basis for the emissions reduction estimate, using the space provided to show any calculations**

- ☐ Actual field measurement ☐ Other (please specify): \_\_\_\_\_  
☐ Calculation using manufacturer specifications/other source

Lessons Learned from Natural Gas STAR Partners

**G. Total value of gas saved:** \$ \_\_\_\_\_

Total value of gas saved = Methane emissions reduction (in Mcf)  
x Gas value (in \$/Mcf) [If not known, use default of \$7.00/Mcf]

**H. To what extent do you expect to implement this practice next year?**

#### Previous Years' Activities

Use the table below to report any past implementation of this PRO, but not previously reported to Natural Gas STAR

Year	Frequency of Practice/Activity or # of Installations	Total Cost of Practice/Activity (incl. equipment and labor) (\$)	Estimated Reductions (Mcf/yr)	Value of Gas Saved (\$)

**PRO Comments:** Please use the back of the page for additional space if needed.

\*Because the implementation of some technologies reduces emissions for multiple years, Natural Gas STAR allows certain activities to count towards a company's emission reductions beyond the initial year of implementation. Natural Gas STAR designates the maximum length of time that these reductions may accrue as "sunset dates." The Appendix lists these sunset dates. Companies can report the corresponding methane emission reductions each year up to the



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*allowable sunset date. Or, companies may wish to report reductions only once for the implementation year, and have EPA automatically apply the sunset date and count those emissions for the allowable number of years.*



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### Additional Program Accomplishments

The Natural Gas STAR Program will use any information entered here to recognize the efforts and achievements of outstanding partners.

Please include any additional information you would like to share about your company's participation in Natural Gas STAR. Examples may include:

- Activities to strengthen your program (e.g., training/education, innovative technologies or activities, pilot projects, employee incentive programs).
- Efforts to communicate your participation and successes (e.g., internal newsletters, press releases, company website).
- Participation in Natural Gas STAR program activities (e.g., contributions to case studies, presentation at annual workshop).

Additional Accomplishments:

**Additional Accomplishments Comments:** *Please use the back of the page for additional space if needed.*



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### Appendix

#### Methane Emission Reduction Technologies & Practices— Production Sector

The list below describes a variety of methane emission reduction technologies that Natural Gas STAR partners in the production sector have implemented and reported to Natural Gas STAR. You may use this list as a guide when completing your annual report. **Sunset dates (i.e., the length of time a technology or practice can continue to accrue emission reductions after implemented) are one year in duration unless otherwise noted in parentheses.** An asterisk (\*) indicates that a technical document related to the technology or practice is available online at [epa.gov/gasstar/tools/recommended.html](http://epa.gov/gasstar/tools/recommended.html).

##### Compressors/Engines

- Automate compressor systems operation to reduce venting
- Catalytic converter installation (10 years)
- Convert to low pressure compressor starters (10 years)
- Eliminate unnecessary equipment and/or systems\*
- Increase compression capacity to reduce venting/flaring
- Install automated air/fuel ratio controls (10 years)\*
- Install electric compressors (10 years)\*
- Install electric motors (10 years)
- Install electric motor starters (10 years)\*
- Install lean burn compressor (10 years)
- Lower compressor purge pressure for shutdown
- Perform gas recovery using slipstream (10 years)
- Redesign blowdown/alter ESD practices\*
- Reduce emissions when taking compressors offline\*
- Reduce gas venting with fewer compressor engine startups and improved engine ignition\*
- Replace compressor cylinder unloaders (10 years)\*
- Replace gas starters with air or nitrogen (10 years)\*
- Turbine fuel use optimization

##### Dehydrators

- Convert pneumatics to mechanical controls (10 years)\*
- Install condensers on glycol dehydrators (10 years)
- Install flash tank separators on glycol dehydrators (10 years)\*
- Reduce glycol circulation rates in dehydrators\*
- Replacing glycol dehydrators with desiccant dehydrators (10 years)\*
- Reroute dehydrator/tank vents to flare or station suction (10 years)\*
- Reroute glycol skimmer gas\*
- Shutdown glycol dehydrator stripping gas in winter
- Use rich glycol in glycol pumps

##### Directed Inspection and Maintenance

- DI&M at compressor stations\*
- DI&M: leak detection using IR camera/optical imaging\*

- DI&M: leak detection using lower emission threshold
- DI&M: survey and repair leaks\*

##### Pipelines

- Inject blowdown gas into low pressure mains or fuel gas system\*
- Pipeline replacement and repair
- Use hot taps for in-service pipeline connections\*
- Use pipeline pump-down techniques to lower gas line pressure before maintenance\*

##### Pneumatics/Controls

- Capture/use gas released from gas-operated pneumatic pumps
- Convert gas pneumatic controls to instrument air (10 years)\*
- Convert natural gas-driven chemical pumps (10 years)\*
- Convert pneumatics to mechanical controls (10 years)\*
- Identify and replace high-bleed pneumatic devices (7 years)\*
- Install controllers on gas-assisted methanol pump (10 years)
- Install/convert gas powered separators to solar powered separators (10 years)
- Install no bleed controllers (10 years)
- Install non-venting dump controllers (10 years)
- Reduce gas pressure on pneumatic devices
- Reduce venting from unlit pilot: install electronic safety devices (10 years)\*
- Replace bi-directional orifice meter with ultrasonic meters\*
- Replace chemical pumps with electronic flow controllers (10 years)
- Use add-on controls to reduce emissions from pneumatics (10 years)

##### Tanks

- Change out vent pallet (10 years)
- Convert water tank blanket from natural gas to CO<sub>2</sub> (10 years)\*
- Eliminate unnecessary equipment and/or systems\*



## Appendix (continued)

### Tanks

- Install evactors (10 years)
- Install flash gas compressors (10 years)
- Install hydrocarbon liquid stabilizer (10 years)
- Install pressurized storage of condensate (10 years)\*
- Install vapor recovery units (VRUs) on storage tanks (10 years)\*
- Install VRUs on pipeline liquid/condensate tanks (10 years)
- Recover gas during condensate loading\*
- Reduce excess blanket gas blow-by to the atmosphere
- Replace leaking above-ground tanks (10 years)
- Route gas to compressor suction/blowcase vessel (10 years)
- Use protective tank coatings to reduce leaks (10 years)

### Valves

- Heat tracing to prevent control valves from freezing open
- Install BASO® valves (10 years)\*
- Install plugs on valves and open ended lines (10 years)
- Test and repair pressure safety valves\*

### Wells

- Artificial lift: gas lift (10 years)
- Artificial lift: install plunger lifts (10 years)\*
- Artificial lift: install pumpjacks or rod pumps on gas wells (10 years)\*
- Artificial lift: install smart lift automated systems on gas wells (10 years)\*
- Artificial lift: install velocity tubing strings (10 years)\*
- Artificial lift: pressure swabbing
- Artificial lift: use capillary strings (10 years)

- Artificial lift: use compression (10 years)
- Artificial lift: use pumping unit (10 years)
- Artificial lift: use to reduce blowdown in gas wells (10 years)\*
- Install automated shut-in cycle units to reduce well venting (10 years)
- Install flash tank separator on water gathering system (10 years)
- Install pumps for separators (10 years)
- Install snubbing unit at wellhead
- Install soap launcher/soap unit (10 years)
- Lower heater-treater temperature
- Optimize gas well unloading times
- Perform reduced emissions completions for hydraulically fractured natural gas wells\*
- Route casinghead gas to VRU or compressor (10 years)\*
- Use foaming agents to reduce blowdown frequency\*

### Other

- Capture and use waste heat to reduce gas usage and emissions
- Convert natural gas-fired generator to solar power (10 years)
- Flare reduction program
- Improve system design/operation
- Install flares (10 years)\*
- Install pilotless burner controls (10 years)
- Install purge reducer on flare (10 years)
- Nitrogen rejection unit optimization\*
- Recover gas from separators
- Re-inject gas for enhanced oil recovery
- Re-inject gas into crude
- Replace aged heaters with new efficient gas fired heaters (10 years)

### Mailing Information:

#### Standard Mail:

*The Natural Gas STAR Program*  
U.S. EPA (6207J)  
1200 Pennsylvania Ave, NW  
Washington, DC 20460  
U.S.A.

#### Express/Overnight Mail:

*The Natural Gas STAR Program*  
U.S. EPA (6207J)  
1310 L Street, NW  
Washington, DC 20005  
U.S.A.

The public reporting and recordkeeping burden for this collection of information is estimated to average 60 hours for each new response and 27 hours for subsequent responses. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.



## ATTACHMENT

## EMISSION CALCULATION METHODS

PRO-1 through PRO-4 reported for Reporting Year 2008, with PRO-3.2009 reported in 2009 as a continuation of PRO-3.

PRO-5, reported in 2009 and amended in 2010 to include the downsizing or replacement of 3 heater treaters. It is related to BMP-1 in that the removal/replacement of the same heater treaters resulted in a reduction of continuous-bleed devices.

PRO-6.2010 is a continuation of PRO-6, which began in 2009.

PRO-7 and PRO-8 reported for reporting year 2010, PRO-8.2011 reported in 2011 as a continuation of PRO-8.

BMP-1 was a 2009 project that was reported in the 2010 report. It is related to PRO-5 in that the removal/replacement of the same heater treaters resulted in reduction of methane emissions due to combustion sources.

### **BMP-1 Pneumatic Devices**

**2009 (not reported in 2009)** – Replaced or removed 3 heater treaters with 3 continuous bleed controllers per heater treater. 2 heater treaters were replaced with smaller units with no-bleed controllers, and 1 heater treater was removed without replacement.

Calculate emissions reductions using the following equation:

$$ER = (AF)(EF)(XCH_4) - 373.18 \times 9 \times 0.926 = 3110 \text{ Mcf/year}$$

Where,

ER = Emissions Reductions (Mcf/year)

AF = Activity Factor (number of devices, or number of plants in processing sector case) = 9

EF = Emissions Factor (Mcf/year/device) = 373.18

Based on 0.71 scfm bleed from 35 psia (supply gas pressure) traditional controller:

$$0.71 \text{ scfm} \times 60 \times 8760 = 373.18 \text{ Mscf/year/device}$$

XCH<sub>4</sub> = Mole fraction of methane in the gas (decimal) = 0.926 from field measurement

References:

*"Process Control Goes Green" in Valve Magazine, Winter 2008*

[http://www.documentation.emersonprocess.com/groups/public/documents/articles\\_articlesreprints/process\\_controls\\_go\\_green.pdf](http://www.documentation.emersonprocess.com/groups/public/documents/articles_articlesreprints/process_controls_go_green.pdf) for full article or

<http://www.valvemagazine.com/index.php/magazine/past-articles/feature-articles/78-winter-2008-process-control-goes-green> for article without figures

### **PRO-5: Eliminate Unnecessary Equipment or Systems**

**2009 project that was not reported previously: Replaced two heater treaters rated at 9,000,000 BTU/hr each with two rated at 750,000 BTU/hr each and removed one heater treater rated at 5,000,000 for a net reduction of 21,500,000 BTU/hr burner capacity.**

Emission reductions were calculated using the following equation:

$$ER = EF \times BR \times HV \times \text{Hours/year}$$

$$ER_p = 2.3 \text{ lb/MMscf} \times 21.5 \text{ MMBTU/hr} \times 1 \text{ scf/1000 BTU} \times 6570 \text{ hours/year} = 324.9 \text{ lb/year CH}_4$$

$$ER = 324.9 \text{ lb/year} \times 1 \text{ lb-mole/16 lbs} \times 379.5 \text{ scf/lb-mole} = 7.706 \text{ Mscf/year}$$

Where,

ER<sub>p</sub> = Methane emission reduction (lbs/year)

ER = Methane emission reductions (Mcf/year)

EF = Emissions Factor = 2.3 lb/MMscf of natural gas combusted

BR = Burner rating reduction = 21.5 MMBTU/hr from replacement with smaller units and one removal with no replacement

HV = Fuel heating value (assume 1000 BTU/scf)

References: API Compendium (2004), which references AP-42, Table 1.4-2.

Assumptions:

Heater treaters are fired 75% of the time = 6570 hours/year

Molecular weight of methane (CH<sub>4</sub>) = 16  
1 mole of an Ideal Gas occupies 379.5 scf

#### **PRO-6.2010 Directed Inspection & Maintenance at Fairway Field Facilities Tank Batteries**

**2010: Continuation of program from 2009. 35 remaining tank hatches were replaced (10 were replaced in 2009). Replacement gaskets found to deteriorate quickly, resulting in leakage, so continued replacing hatches into 2010.**

$$\begin{aligned}ER &= EF(AF)(XCH_4)(70\%) \text{ reduction on average through DI\&M} \\ER &= (82.80)(35)(0.926)(0.70) = 1878.5\end{aligned}$$

Where,

ER = Emissions Reductions (Mcf/year)

EF = Emissions Reductions Factors (Mcf/year) = 82.80 MCF/yr natural gas per component\*

AF = Activity Factor (number of components) = 35

XCH<sub>4</sub> = Mole fraction of methane in the gas (decimal) = 0.926 from measurement

\* Obtained from [epa.gov/gasstar/documents/xls/quantifying\\_ngs\\_methane\\_reductions.xls](http://epa.gov/gasstar/documents/xls/quantifying_ngs_methane_reductions.xls) in Worksheet "Other", DI&M at Remote Sites for Gas Plant/Non-compressor related

#### **PRO-7 Compressor Rod Packing Replacement**

**Replaced rod packing on 3 compressors**

Pipeline Research Committee International reports typical emissions reductions of 865 Mcf/year/packing replacement.

Calculate the emissions reductions using the following equation:

$$\begin{aligned}ER &= AF(865 \text{ Mcf/year/packing replacement}) (XCH_4) \\ER &= 3(865)(0.926) = 2403 \text{ Mcf}\end{aligned}$$

Where,

ER = Emissions Reductions (Mcf/year)

AF = Activity Factor (number of rod packing replacements/year) = 3

XCH<sub>4</sub> = Mole fraction of methane in the gas (decimal) = 0.926 from field measurement

References:

Equation to estimate emissions – From EPA Natural Gas STAR spreadsheet, "Natural Gas STAR Recommended Technologies and Practices - Quantification Methods", referencing Reducing Methane Emissions from Compressors and Rod Packing Systems Lessons Learned  
[http://www.epa.gov/gasstar/documents/ll\\_rodpack.pdf](http://www.epa.gov/gasstar/documents/ll_rodpack.pdf)

#### **PRO-8 Redesign Blowdown Systems (Compressors)**

**Re-route blowdown exhaust to suction line for 11 compressors.**

1.9 Mscf/blowdown = calculated blowdown volume from compressor maintenance contractor:  
Approximately 40 blowdowns/month now routed to the compressor suction line rather than vented.

$$\begin{aligned}ER &= AF(1.9 \text{ Mscf/blowdown})(XCH_4) \\ER &= 480(1.9)(0.926) = 844.5 \text{ Mcf/year}\end{aligned}$$

Where,

ER = Emissions Reductions (Mcf/year)

AF = Activity Factor (number of blowdowns/year) = 480

XCH<sub>4</sub> = Mole fraction of methane in the gas (decimal) = 0.926 from field measurement

**PRO-8.2011 Redesign Blowdown Systems East Haynesville Field (Compressors)**

**Re-route blowdown exhaust to suction line for 10 compressors.**

0.12 Mscf/blowdown = averaged blowdown volume from compressor maintenance contractor:  
Approximately 18 blowdowns/month now routed to the compressor suction line rather than vented,  
based on averaged data obtained from TOW.

$$\begin{aligned}ER &= AF(0.12 \text{ Mscf/blowdown})(XCH_4) \\ER &= 214(0.12)(0.926) = 23.8 \text{ Mcf/year}\end{aligned}$$

Where,

ER = Emissions Reductions (Mcf/year)

AF = Activity Factor (number of blowdowns/year) = 214

XCH<sub>4</sub> = Mole fraction of methane in the gas (decimal) = 0.926 from field measurement